EFFECTS OF SPECIMEN SIZE AND SHAPE ON COMPRESSIVE STRENGTH OF FOAMED CONCRETE CONTAINING SPENT BLEACHING EARTH AND KENAF FIBER

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I hereby declare that I have checked this thesis and in my opinion, this thesis is adequate in terms of scope and quality for the award of the Bachelor Degree of Civil Engineering.

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STUDENT'S DECLARATION

I hereby declare that the work in this thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at Universiti Malaysia Pahang or any other institutions.

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ABSTRAK

Penyelidikan ini mengkaji kesan saiz dan bentuk spesimen pada kekuatan mampatan konkrit berbuih yang mengandungi Processed Spent Bleaching Earth (PSBE) dan Kenaf Fiber. Terdapat dua campuran yang disediakan iaitu PFC (30% daripada PSBE sebagai penggantian simen separa simen dan PKF (30% PSBE + 0.5% Kenaf Fiber). Ketumpatan campuran direka sebagai 1600 kg / m^3 Semua spesimen telah diuji untuk menentukan kebolehkerjaan dengan mengukur aliran campuran dan ujian mampatan untuk menentukan kekuatan mampatan konkrit berbuih. Kajian ini difokuskan untuk menentukan kesan saiz dan bentuk pada kekuatan mampatan konkrit berbuih pada 7 hari, 14 hari dan 28 hari. Saiz dan bentuk spesimen yang digunakan untuk kekuatan mampatan ialah saiz 150x150x150mm, 100x100x100mm dan 50x50x50mm dan silinder 150 x 300 mm dan 100 x 200 mm. Dari hasil eksperimen, kedua-dua campuran menunjukkan kekuatan mampatan untuk semua saiz dan bentuk daripada spesimen dari 7 hari hingga 28 hari. Campuran PFC memberikan kekuatan mampatan tertinggi mencapai 17.0 MPa dalam saiz kiub 100x100x100mm dan 150x150x150mm pada 28 hari, dan dalam campuran PKF, mencapai 11.0 MPa dalam saiz kiub 100x100x100mm dan 150x150x150mm pada 28 hari. Sebaliknya, kekuatan mampatan saiz silinder 100x200 mm diameter adalah 21% lebih besar daripada diameter 150x300 mm yang mencapai 19.0 MPa dan 15 MPa dalam PFC. Juga, kekuatan mampatan saiz silinder 100x200 mm diameter adalah 30% lebih besar daripada diameter 150x300 mm yang mencapai 20 MPa dan 14 MPa dalam PKF.

ABSTRACT

Present research studies the effects of specimen size and shape on compressive strength of foamed concrete containing Processed Spent Bleaching Earth (PSBE) and Kenaf Fiber. There are two mixtures were prepared which namely PFC (30% of PSBE as partial cement replacement of cement and PKF (30% PSBE + 0.5% Kenaf fiber). The mix density was design as 1600 kg/m^3. All specimens were tested to determine the workability by measure the flow table of the mixtures and compression test to determine the compressive strength of foamed concrete. This study was focused to determine the effect of size and shape on compressive strength of foamed concrete at 7 days, 14 days and 28 days. The size and shape of specimens used for compressive strength were cubes of size 150x150x150mm, 100x100x100mm and 50x50x50mm and cylinders of 150 x 300 mm and 100 x 200 mm. From the experimental results, both mixtures showed increase in the compressive strength for all sizes and shape of specimens from 7days to 28 days. As compared to PFC mix, the highest compressive strength achieved 17.0 MPa in cubes size 100x100x100mm and 150x150x150mm at 28 days, and in PKF mix, the highest compressive strength achieved 11.0 MPa in cube size 100x100x100mm and 150x150x150mm at 28 days. In other hand the compressive strength of cylinders size 100x200 mm diameter was 21% greater than 150x300 mm diameter which achieved 19.0 MPa and 15 MPa in PFC. Also, the compressive strength of cylinders size 100x200 mm diameter was 30% greater than 150x300 mm diameter which achieved 20 MPa and 14 MPa in PKF.

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LIST OF ABBREVIATIONS

PSBE	Processed Spent Bleaching Powder
FC	Foamed Concrete
LFC	Lightweight foamed concrete
OPC	Ordinary Portland cement
ASTM	American Society for Testing and Materials
FKASA	Fakulti Kejuruteraan Awam dan Sumber Alam
UTM	Universal Testing Machine
UMP	Universiti Malaysia Pahang
US	United State
w/c	Water-Cement ratio
s/c	Sand-Cement ratio
MgO	Magnesium Oxide
SO_3	Sulphur Trioxide
CO_2	Carbon Dioxide
CH	Calcium Hydroxide
CSH	Calcium Silicate Hydrate
C_3S	Tricalcium Silicate
CaO	Calcium Oxide
SiO_2	Silicon Dioxide
Al_2OH_3	Aluminium Trioxide
Fe_2O_3	Ferric Oxide
Kg/m^3	Kilogram per meter cube
Mpa	Mega Pascal
lbs	Pound
pints	Unit of Volume
L	Litre
mm	Milimeter
h	Hour
cm^2/g	Centimeter square per gram
kN	kilo Newton
kN/s	kilo Newton per second
kPa	kilo Pascal
℃	Degree Celcius
%	Percentage

CHAPTER 1

INTRODUCTION

1.1 Background of study

The cylinder specimen of concrete (150mm diameter and 300mm height) is a standard specimen to test the compressive strength in United States. While in Britain and Europe, the standard specimen for testing the compressive strength is a cube specimen of concrete by size 150 × 150 × 150 mm (Abdullah, Mohd Mustafa et al 2012). The cubes are smaller compared with the cylinder specimen of concrete, and the advantages of cylinders do not depend on the quality and condition of the mould and that their density can be more readily and accurately established by weighing and measuring (Jignesh, Kerai 2015).

Foamed concrete is one of the most important building materials. It has wide range of applications. It can be cast in-place for a unit low cost terrace houses and bungalow and also high-rise building. Other applications are it can be used for lightweight brick or block, panels and partition walls of various dimensions either precast or poured in place, insulation works, cavity walls, roofing, ceiling panels, road a sidewalk and other. In addition, foamed concrete can be used in building construction, low cost house, highway construction, blinding, void filing, footing, tunnel lining, trench reinstatement, roof insulation and light weight purposes. The application of foamed concrete depends on the density of the foam concrete itself (Narayanan, N 2000).

Kenaf Fiber is seen as a promising green material as it reused natural resources in the concrete. Furthermore, owning to the benefits of Fiber's tensile properties, inclusion of Kenaf Fiber in concrete resulted in better flexural and shear strength and ductility of the reinforced concrete structure. However, to ensure good performance, Kenaf Fiber, similar like other type of natural Fiber need to undergo some treatment to reduce high water absorption characteristic of the Fiber. One of the treatments recommended is to use a chemical such as sodium hydroxide (NaOH) to reduce the hydrophobic characteristic of the Fiber, thus enhancing the adhesion between the Fiber surface and the matrix. This was done by removing the hydroxyl group in cellulose and increasing the surface roughness which resulted in the improvement of the tensile properties of Kenaf Fiber as compared to untreated Kenaf Fiber (ASTM C1202 2012).

Pre-treatment of crude palm oil (CPO) during a refining process which involves degumming and bleaching, generates plentiful of spent bleaching earth (SBE). Bleaching earth is a very fine powder and its main component is silicon dioxide (~57% and more depending on the type). It is prepared by treating montmorillonite clay (represented by $Al_2O_3\ 4SiO_2\ nH_2O$) with mineral acids and by eluting basic components such as aluminium, iron and magnesium. SBE is a discarded palm oil refinery (POR) waste containing a high percentage of residual oil. PSBE has been incinerated for cement manufacturing but there is difficult in maintaining good cement quality due to the high concentration of oil in PSBE (Chem. Soc 1983).

Presently, this research is to investigate the effect of specimen size and shape on compressive strength of foamed concrete containing Kenaf Fiber and Processed Spent Bleaching Earth (PSBE) and use it as a partial cement replacement in foamed concrete in term of strength.

1.2 Problem statement

Nowadays, speedy development in our country makes the excessive uses of normal cement (OPC). OPC produces around one tone of carbonic acid gas per tons created according to Mahachi J, Golinger A M & Wagenaar F, (2004), raising vital

environmental considerations. Because the OPC isn't noticeably economical friendly, several researches are done to exchange the utilization of OPC, as Associate in nursing example the combination is replaced with foam. Thus, makes the concrete lighter. It's found that the compressive strength of foamed concrete is principally influenced by density according E. P. Kearsley & H. F. Mostert, (2005). So, the scale and form of specimen becomes a very important parameter for the compressive strength of foamed concrete according Sarıdemir (2013).

1.3 Objectives of study

The goal of this study is to investigate the effect of specimen size and shape on compressive strength of foamed concrete containing Processed spent bleaching earth and Kenaf Fiber. The specific objectives of this study are:

i. To determine the effect of size on compressive strength of foamed concrete.
ii. To determine the effect of shape on compressive strength of foamed concrete.
iii. To determine the workability of foamed concrete by using Flow Table Test.

1.4 Scope of Study

This study was done to determine the effect of specimen size and shape with containing spent bleaching earth and Kenaf Fiber in foamed concrete properties. The materials were mixed according to ratio of 30% of PSBE and 0.5% of Kenaf fiber with foamed concrete. It is focused on the influence of specimen on the workability and compressive strength. The compressive strength tests were done at 7, 14 and 28 days. All of the materials and specimen preparation is based on standard code practice requirement of ASTM. The data from the result were analyzed to determine the effect the specimen size and shape on the compressive strength of foamed concrete.

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